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Adapted OMB No. 0661-0011 (12/31/86)

PATENT APPLICATION TRANSMITTAL LETTER

Docket Number

BLANKET-3588

Commissioner of Patents and Trademarks, Washington, D.C. 20231  
TO THE COMMISSIONER OF PATENTS AND TRADEMARKS:

Transmitted herewith for filing is the patent application of Richard H. Hall and Theodore W. Selby, both of Midland, Michigan,  
for INERT GAS BLANKET FOR PROTECTION FROM OXIDATION.

Enclosed <sup>12-page</sup> is the written specification hereof to include at least one claim, plus:

- ☒ One (1) sheet(s) of drawing(s) as part of the specification hereof.  
☐ an assignment of the invention to \_\_\_\_\_  
☒ Inventor(s)'s declaration, attached to the specification.  
☐ a certified copy of a \_\_\_\_\_ application.  
☐ associate power of attorney and/or power of attorney SEPARATE from above declaration.  
☒ a verified statement to establish small entity status under 37 CFR 1.9 and 1.27. (vs/RHN & TWS).  
☐ Information Disclosure Statement/Citation.  
☒ Preliminary Amendment.

CLAIMS AS FILED

After any preliminary amendment entered ...

	NUMBER FILED	NUMBER EXTRA	RATE	FEE
BASIC FEE			\$790	\$790
TOTAL CLAIMS	22 - 20 =	* 2	x \$22	44
INDEPENDENT CLAIMS	4 - 3 =	* 1	x \$82	82
MULTIPLE DEPENDENT CLAIM PRESENT			\$ —	—
* NUMBER EXTRA MUST BE ZERO OR LARGER			TOTAL	\$ 916
If applicant is a small entity under 37 CFR 1.9 and 1.27, then divide total fee by 2, and enter amount here.			SMALL ENTITY TOTAL	\$ 458

- ☒ A check in the amount of \$ 458<sup>00</sup> to cover the ~~total fee(s)~~ is enclosed (check number 654).  
☒ CERTIFICATE OF MAILING BY EXPRESS MAIL UNDER 37 CFR 1.10:

"Express Mail" mailing label number EE231664116US  
Date of deposit October 13, 1998 A.D.

I hereby certify that this correspondence is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to  
ASSISTANT COMMISSIONER FOR PATENTS  
WASHINGTON DC 20231.

Dated: Oct. 13, 1998 Signed: Christopher John Rudy  
Christopher J. Rudy

- ☒ Address all communications to: CHRISTOPHER JOHN RUDY  
209 HURON AVE  
PORT HURON MI 48060  
Telephone (810) 982-4221.

Oct. 13, 1998  
Date

Christopher John Rudy  
Signature PTO #31878

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Re Richard H. Hall and Theodore W. Selby  
Attorney Docket No. BLANKET-358 - Filing Herewith  
For INERT GAS BLANKET FOR PROTECTION FROM OXIDATION

Preliminary Amendment

Assistant Commissioner for Patents, Washington, D.C. 20231:

Please amend the specification of this application:

In the Written Description

At page 1, immediately after the title, between lines 1 & 2,  
insert the following paragraph:

-- This claims the benefit of U.S. provisional patent  
application serial number 60/062,133 filed 10/15/97. --.

At page 2, line 14, insure that "argon" is deleted and that  
-- HALON(R)/FREON(R) -- is inserted therefor from the right hand  
margin.

At page 5, line 23, delete " "membrane," i.e., hollow fiber,"  
and insert therefor -- hollow fiber membrane --.

At page 7, line 1, insert the following sentence after the  
sentence ending with the word "truck." -- The device 50 may  
provide argon or carbon dioxide from air by use of a membrane. --

At page 8, line 23, delete the inserted "a" entirely.

In the Claims

Cancel without prejudice or disclaimer claims 1-15.

In claim 18, line 1, delete "which" entirely.

In claim 19, line 2, insert -- of -- before "air."

-- 21. A protected item in a movable vehicle comprising a  
generally enclosed space for containing an oxidatively labile  
substance, and attached in communication thereto an inert gas  
device for providing an inert gas blanket to said space to assist  
in protecting the oxidatively labile substance from oxidation,

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provided that if said item is a tank car said inert gas is not flue gas.

22. The item of claim 21, wherein said inert gas is enriched in or is pure nitrogen or argon.

23. The item of claim 21, wherein said device includes a membrane for separating said inert gas from air.

24. The item of claim 23, wherein said inert gas is enriched in or is pure nitrogen.

25. The item of claim 21, wherein said item is is at least one of an engine crankcase, a transmission, or another gear box; and the oxidatively labile substance is an oil or a transmission fluid.

26. The item of claim 21, wherein said item is an engine crankcase, and the oxidatively labile substance is an engine oil.

27. The item of claim 24, wherein said item is the engine crankcase, and the oxidatively labile substance is an engine oil.

28. The item of claim 21, wherein said item is at least one of a fuel tank or an electric wire raceway.

29. The item of claim 24, wherein said item is at least one of a fuel tank or an electric wire raceway.

30. The item of claim 27, which is in an aircraft.

31. The item of claim 24, which delivers to a substantially enclosed place away from said space a gas which is enriched in or is pure oxygen.

32. The item of claim 31, wherein said place is at least one of a combustion chamber of an engine or a catalytic converter.

33. The item of claim 31, wherein said place is for a passenger or pilot of the movable vehicle.

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34. A protected item of stationary machinery comprising a generally enclosed space for containing an oxidatively labile substance, and attached in communication thereto an inert gas device for providing an inert gas blanket to said space to assist in protecting the oxidatively labile substance from oxidation.

35. The item of claim 33, wherein said inert gas is enriched in or is pure nitrogen, argon or carbon dioxide; said device includes a membrane for separating said inert gas from air; and said device is at least one of a fuel tank, an engine crankcase, a transmission, or another gear box.

36. A protected static building structure comprising a generally enclosed space for containing an oxidatively labile substance, and attached in communication thereto an inert gas device for providing an inert gas blanket enriched in or pure nitrogen, argon or carbon dioxide to said space to assist in protecting the oxidatively labile substance from oxidation, wherein said device includes a membrane for separating said inert gas from air.

37. The structure of claim 38, which is a flour elevator or silo, wherein said inert gas is enriched in or is pure nitrogen. --

#### REMARKS

Please examine this application. The present amendments, which more clearly and fully describe and more particularly point out and distinctly claim the invention, are fully supported by the specification, and no new matter is entered. A supplemental declaration, however, will be filed to forestall any contrary question, and to indicate that Dr. Hall executed the declarations on October 9, 1998 in anticipation of the 10th when he expected Mr. Selby to sign them.

Respectfully submitted,

Dated: October 13, 1998

*Christopher John Rudy*, PTO #31873  
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(2-92)

**VERIFIED STATEMENT CLAIMING SMALL ENTITY STATUS  
(37 CFR 1.9(f) & 1.27(b))--INDEPENDENT INVENTOR**Docket Number (Optional)  
BLANKET- 358Applicant or Patentee: Richard H. Hall and Theodore W. SelbySerial or Patent No.: UtilityFiled or Issued: ConcurrentlyTitle: INERT GAS BLANKET FOR PROTECTION FROM OXIDATION

As a below named inventor, I hereby declare that I qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees to the Patent and Trademark Office described in:

- ☒ the specification filed herewith with title as listed above.  
☐ the application identified above.  
☐ the patent identified above.

I have not assigned, granted, conveyed or licensed and am under no obligation under contract or law to assign, grant, convey or license, any rights in the invention to any person who would not qualify as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

- ☒ No such person, concern, or organization exists.  
☐ Each such person, concern or organization is listed below.

Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code; and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

Richard H. Hall

NAME OF INVENTOR

Signature of Inventor

Date

Theodore W. Selby

NAME OF INVENTOR

Signature of Inventor

Date

NAME OF INVENTOR

Signature of Inventor

Date

## INERT GAS BLANKET FOR PROTECTION FROM OXIDATION

### FIELD

This invention concerns provision of a non-oxidizing gas blanket, for protection from oxidation, to include, for example, for fuels and lubricants such as present in fuel tanks, bearings, crankcases, gear boxes, transmissions, and so forth, used in or in conjunction with internal combustion, jet and turbine engines. Protection from combustion in enclosed spaces, to include wiring raceways, and explosion with other explosive mixtures are also of concern, for example, in static building structures containing carbonaceous particulate matter which may become suspended in air and can present a safety problem, for example, silos or buildings which contain grain, flour, and so forth and the like.

### BACKGROUND

One of the primary enemies of longevity in hydrocarbon-based lubricants is oxidation. For example, engine oils employed in automobiles, transportation and stationary power units break down significantly owing to oxidation and must be replaced every few thousand miles, or after a certain number of hours, of use.

As well, oxidation can be a foe of safety when it comes to fuel tank explosions and so forth. For example, automobiles under crash conditions may encounter such explosions; aircraft fuel tanks have been known to explode, and the wiring of aircraft may start on fire. Ship tankers carrying fuels are particularly at risk, and most are now "inerted" when traveling unloaded.

Railroad tank cars and tank trucks are also of concern. In tanked vehicles, flue gas, rich in carbon dioxide, may be piped to the tank to hopefully protect its contents if an explosive condition would exist due to the presence of a fuel and oxygen.

Furthermore, the dumping of used oil is one of the major sources of pollution in landfills. Moreover, harmful substances accompanying the used oil are carried into the landfills.

Further, static building structures containing carbonaceous particulate matter which may become suspended in air can present a safety problem. For example, silos or buildings which contain grain, flour and/or other carbonaceous particulate matter such as may be provided by sawdust have been known to explode. In addressing this matter, silo explosion detectors are known, which detect an explosion at its onset and inject argon gas therein to hopefully minimize or alleviate explosive wave front propagation. However, such systems are not without their drawbacks.

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It would be desired to overcome or ameliorate such problems.

#### SUMMARY

The invention provides an inert gas blanket for protection from oxidation. Such includes, for example, for fuels and lubricants such as present in fuel tanks, bearings, crankcases, gear boxes, transmissions, and so forth, employed in or in conjunction with internal combustion, jet and turbine engines.

The invention is useful in conservation and public safety.

Significantly by the invention, the useful life of oleaginous

liquids and hydrocarbon-based lubricants can be extended to most amazing lengths. For example, with the practice of the present invention, it may be necessary to change automobile engine oil only after twenty to fifty thousand miles of use or more. As well, by the invention, less and less oil will find its way into landfills since the major reason so much oil is found unsuitable for use and is dumped is due to the oil becoming oxidized; the oxidation of oil generates organic acids, ketones, aldehydes and other varnish-like and/or corrosive compounds, which, in general, must be dumped while still dissolved or suspended in the oil, or cause damage to the operating mechanism which the oil lubricates. The retardation of the process of forming these components, i.e., the oxidation, will not only minimize the consumption of oil such as will be drained and dumped by the consumer, which is of real economic value to him, but also will provide for a reduced load on the environment in waste handling and disposal of the used oil, which can be estimated in millions of gallons per year. In addition, the likelihood of fuel tank explosions in air, land and sea vehicles and stationary machinery, and as well the likelihood of electrical fires in wiring raceways as found in aircraft, can be effectively reduced. Furthermore, buildings such as grain or flour silos, sawdust containing buildings, etc., can be inhibited from explosion. The invention is simple; it is inexpensive to implement, and it is efficient.

Numerous further advantages attend the invention.



### DRAWINGS

The drawings form part of the specification hereof. With respect to the drawings, where like numerals indicate like features, the following is briefly noted:

FIG. 1 is a plan view of an inert gas blanket provision of the invention for protection of engine oil in an internal combustion engine in an automobile.

FIG. 2 is a plan view of inert gas blankets of the invention for protection of a fuel tank and a wire raceway in an airplane.

FIG. 3 is a plan view of an inert gas providing membrane separator, which can be used in the practice of the invention.

FIG. 4 is a plan view of an inert gas blanket provision of the invention for protection of a flour silo.

### ILLUSTRATIVE DETAIL

The invention can be further understood by the present detail which may be read in view of the drawings. The same is to be taken in an illustrative and not necessarily limiting sense.

Herein, in general, in reference to a gas, the term "inert" means non-oxidizing. Generally so, an "inert gas blanket" is a non-oxidizing gas blanket. Preferred is a nitrogen-enriched gas.

In reference to the drawings, in general, in FIGS. 1 & 2, protected machinery 100 is depicted, which includes housing 1 and generally enclosed device 10 having oxidatively labile substance 11 therein. For example, in FIG. 1 is depicted protected automobile 100 having body 1, internal combustion engine 10,

which may be diesel or gasoline powered, and lubricating motor oil 11; in FIG. 2 is depicted protected airplane 100 having body 1, and amidship, fuel tank 10 and fuel 11, and fore, electrical wire raceway 10 containing electrical wire 11 having combustible insulation and so forth. Inert gas providing device 50 can provide the inert gas blanket for protection from oxidation of the oxidatively labile substance 11. The device 50 can be take the form of an inert gas tank such as pressurized or liquid argon, nitrogen and/or carbon dioxide, and so forth and the like, or any other device which can provide inert gas to the device 10 so as to protect the substance 11 from oxygen or at least high concentrations of oxygen such as found in ambient air. As an alternative, the device 50 may generate the inert gas as, for example, a nitrogen blanket or at least a gas blanket having enriched concentrations of nitrogen in comparison to ambient air such as through employment of membrane technology and so forth. As such, and as not only generally depicted in FIGS. 1 & 2 but also depicted in FIG. 3, the device 50 may include membrane separating device 51, which can separate air into a plurality of fractions, for example, two fractions, one containing an enriched supply of nitrogen, the other having an enriched supply of oxygen as a byproduct, and such a device may be of the pressurized "membrane," i.e., hollow fiber, type so as to enable economical separation; first conduit 52 leads from the nitrogen enriched side of the device 51 to pump 53, which may be, for example, of

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the type commonly employed in compressed air, enhanced shock absorbers used for level control or for light trucks, or be of another suitable variety; second conduit 54 leads from the pump 53 to fitting 55 leading to the interior of the engine or fuel tank 10 where inert gas blanket 56, for example, of the gas enriched with nitrogen, is provided. The pump 53, and optional small reservoir storage tank 57 for storage of inert gas and/or for byproduct gas, as appropriate, can be placed in any suitable position on, in, or in association or conjunction with the protected machinery 100. With tube-type membrane gas separators, since they typically operate better under a high pressure inlet stream, the inlet of the separating device 51 is placed at the outlet of the pump 53. Optionally, by-product gas, say, enriched with oxygen, may be delivered to another part of the machinery where it can be consumed, for example, to a catalytic converter assembly, a fuel injector assembly, or, as depicted in FIG. 1, to an air cleaner assembly for intake to the carburetor, through third conduit 58. In the former case, an advantageous feature of providing the byproduct gas enriched in oxygen thereto is that it can be used in the initial starting of an internal combustion engine when the catalytic converter is otherwise at its minimum activity, or, in other words, its maximum pollutant generation, level, so as to alleviate the same. Another advantage of using the byproduct enriched oxygen stream is to enhance the loss of oxygen in a sealed cabin space such as that found in aircraft or

even in the passenger compartment of a boat, automobile or truck.

In general, as is known in the art, membrane separators, which can include the membrane separator 50, work on the following principles:

For fluids, rolled film sheets are used.

For gasses, fine microfiber tubes 59 are used (FIG. 3).

Desirably, the tubes 59 are small in diameter so as to allow higher pressure differentials on opposing sides of the membrane. The cylindrical shape is extrudable for cost reasons and allows for side wall thickness control.

The membranes are semipermeable, and the semipermeable membrane units can be large to provide adequate volume throughput. Alternatively, they may be provided in series to provide high efficiency, high percentage separations, i.e., purer exit streams.

The rolled film units are more often used for liquids since the weight of product passing through, as can be measured by its density, is greater, but mainly because some part of the fluid, for example, entrained salts, must be flushed through, or else that part will block the film. In the example of FIG. 3, both "A" and "B" streams are gasses. Therefore, there will be no deposits or blinding of the membrane, if the gasses are properly filtered at the inlet end.

For dirty, or dusty, areas, an inlet end particulate filter

(not illustrated) is desirable. The filter can have an automatic backflush feature on pressure drop indication. Various membranes may be commercially obtained and used as is or adapted for use in the practice of the invention. For example, membrane-based, nitrogen enhancing technology is available from MG Generon of Malvern, Pa.

In reference to FIG. 4, in general, protected enclosed static structure 200 includes housing 1 and generally enclosed structure 10 having oxidatively labile substance 11 therein. For example, the oxidatively labile substance may be flour dust suspended in otherwise ambient air. The membrane separating device 50 can be provided proximate the silo 200, with, for example, a nitrogen enriched supply of inert gas pumped inside the silo 200 through conduit 54 to help protect from explosion, and byproduct gas enriched in oxygen diverted elsewhere outside the silo 200. Internal pressure relief opening and/or valve 60 may be provided.

The device 50 may be retrofitted to a standard, generally enclosed device 10 to provide the protected machinery 100 or static structure 200. For an illustrative example, such may be adapted especially for and made available in the automotive aftermarket for retrofitting with a standard automotive engine, or adapted especially for and made available in the heavy machinery market for retrofitting with standard locomotive, farm tractor, over the road truck, or ship engines. Along such lines, such may be applied within a standing grain or flour silo complex

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so as to provide an inexpensive source of non-oxidizing gas to help prevent explosions of suspended flour dust. Additional examples of the protected machinery 100 can include liquid fuel tanks, transmissions, gear boxes, hydraulic brake systems and/or wire raceways of electrical, gasoline or diesel powered watercraft, land motor vehicles, locomotive railroad engines, farm machinery, home gardening tractors and lawn mowers, commercial or industrial and home electrical generators, welders, and so forth; truck, railroad or ship tank cars, trailers or bays for fuels or combustible or oxidation sensitive reactants or solvents; stationary farm, industrial and home tanks for gasoline, diesel, oil, combustible or oxidation sensitive reactants or solvents; and so forth and the like.

In general, the invention may apply to any system in which a substantially enclosed space or a space to which an overpressure can be applied contains an oxidizable material. The actual possibilities of application of the invention are extensive.

#### CONCLUSION

The present invention is thus provided. Various features, subcombinations and combinations of the invention may be practiced with or without reference to other features, subcombinations or combinations in the practice of the invention, and numerous adaptations and modifications can be effected within its spirit, the literal claim scope of which is particularly pointed out as follows:

We claim:

1. A protected item comprising a generally enclosed space for containing an oxidatively labile substance, and attached in communication thereto an inert gas device for providing an inert gas blanket to said space to assist in protecting the oxidatively labile substance from oxidation.

2. The item of claim 1, wherein said device provides said inert gas which is enriched in or is pure nitrogen, ARGON OR CARBON DIOXIDE.

3. The item of claim 2, wherein said device includes a membrane for separating said inert gas from air.

4. The item of claim 3, which delivers to a place away from said space a gas which is enriched in or is pure oxygen.

5. The item of claim 3, which is a fuel tank.

6. The item of claim 3, which is an electrical wire raceway.

7. The item of claim 3, which is a hydraulic brake system, a tank for transporting a liquid fuel or combustible or oxidation sensitive reactant or solvent, and a combination thereof.

8. The item of claim 1, which is selected from the group consisting of a transmission box, a gear box, and a crankcase of an internal combustion engine; and the oxidatively labile substance is an oil or transmission fluid.

9. The item of claim 3, which is selected from the group consisting of a transmission box, a gear box, and a crankcase of an internal combustion engine; and the oxidatively labile substance is an oil or transmission fluid.

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10. The item of claim 8, which is said engine crankcase.

11. The item of claim 9, which is said engine crankcase.

12. The item of claim 4, wherein said place is selected from the group consisting of a carburetor, fuel injector, catalytic converter and a combination thereof.

13. The item of claim 4, wherein said place includes a pilot, driver or passenger cabin or compartment.

14. The item of claim 3, which is stationary.

15. The item of claim 14, which is a grain elevator or silo.

16. A method for controlling oxidative degradation of an oleaginous liquid substance in a generally enclosed space in a working machine, which comprises providing an inert gas blanket to said space.

17. The method of claim 16, wherein said oleaginous liquid substance is an oil or transmission fluid, and said machine is selected from the group consisting of a transmission box, a gear box, an internal combustion engine, and a combination thereof.

18. The method of claim 17, wherein said inert gas which is enriched in or is pure nitrogen.

19. The method of claim 18, wherein said inert gas is provided from separation air with a membrane-containing device.

20. The method of claim 19, wherein said oleaginous liquid substance is an engine oil; said machine is the internal combustion engine, and it is necessary to change the oil only after twenty thousand miles of use or more.



**ABSTRACT**

Inert gas blanket protects oxidatively labile substance from oxidation. For example, fuels and lubricants such as present in fuel tanks, bearings, crankcases, gear boxes, transmissions, and so forth, employed in or in conjunction with internal combustion, jet and turbine engines, or a combustible substance such as flour dust in a grain silo, can be protected with a nitrogen blanket provided from the separation of air with a membrane containing device. Useful life of oleaginous liquids and hydrocarbon-based lubricants can be extended. For example, with the practice of the present invention, it may be necessary to change automobile engine oil only after twenty to fifty thousand miles of use.

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Sheet 1 of 1

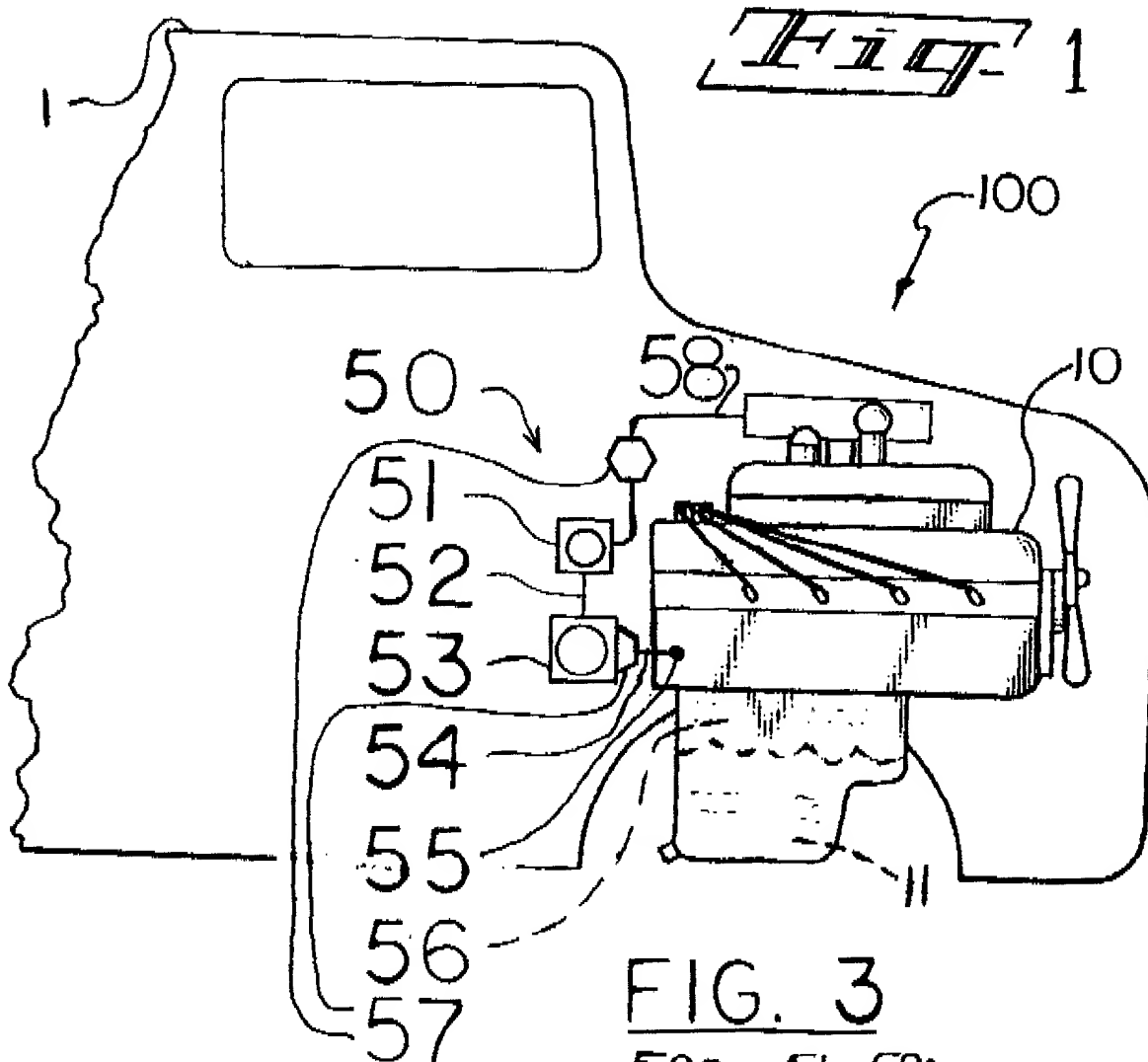


FIG. 3

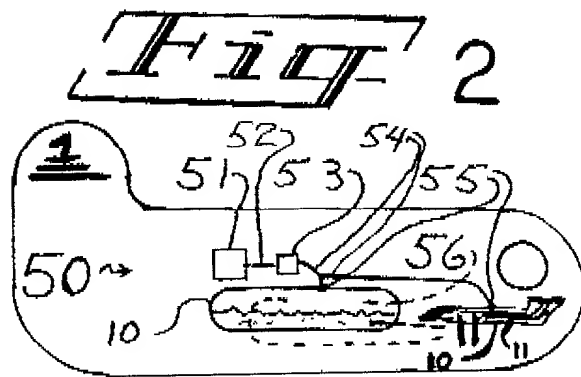
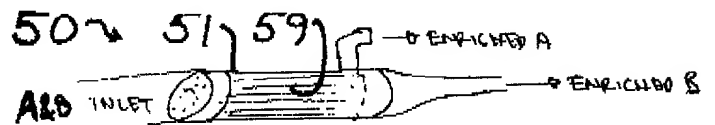
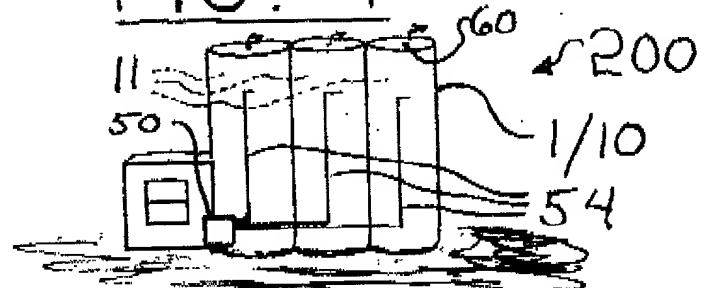


FIG. 4



DECLARATION FOR U.S. PATENT APPLICATION WITH POWER OF ATTORNEY

As below named inventor, I hereby state and declare that:

My citizenship, residence, and post office address are as stated next to my name and signature below.

I believe I am an original, first and joint inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled INERT GAS BLANKET FOR PROTECTION FROM OXIDATION of which a specification is attached hereto (Docket No. BLANKET-358).

I have reviewed and understand the contents of the above-identified specification, including its claims.

I acknowledge the duty to disclose information material to patentability of this application under 37 CFR 1.56. Under this section, information is material to patentability when it is not cumulative to information not already of record in the application, and it establishes, by itself or in combination with other information, a prima facie case of unpatentability of a claim, or it refutes, or is inconsistent with, a position I take in opposing an argument of unpatentability relied upon by the U.S. Patent and Trademark Office, or in asserting an argument of patentability.

I claim the benefit under 35 USC 119(e) of U.S. provisional patent application number 60/062,133 filing date 10/15/97.

I appoint Christopher John Rudy, Reg. No. 31873  
209 HURON AVE, PORT HURON MI 48060  
Phone (810) 982-4221

with full power of substitution and revocation, to prosecute this application and transact all business in the U.S. Patent and Trademark Office connected therewith (to include any abandonment thereof) and to whom all written and oral communications should be directed therefor.

All statements made herein, of my own knowledge are true, and on information and belief are believed to be true, and further, these statements were made with the knowledge that willful false statements and the like so made are punishable by fine and/or imprisonment under 18 USC 1001, and that such willful false statements may jeopardize the validity of the present application or any patent issued thereon.

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MIDLAND MI 48640

Signature [Signature]

Date October 10, 1998

Signature Theodore W. Selby

Date 981010

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